

1 **CLAIMS:**

2 1. A conductive integrated circuit metal alloy interconnection
3 comprising an alloy of copper and silver, with silver being present in
4 the alloy at from less than 1.0 at% to 0.001 at%.

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6 2. The interconnection of claim 1 wherein silver is present in
7 the alloy at from 0.005 at% to 0.1 at%.

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9 3. The interconnection of claim 1 having higher electromigration
10 resistance than copper of a purity of greater than 99.999% of the same
11 grain size.

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13 4. The interconnection of claim 1 having greater thermal
14 stability to grain size retention and crystal orientation retention than
15 copper of a purity of greater than 99.999% of the same grain size.

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17 5. A physical vapor deposition target comprising an alloy of
18 copper and silver, with silver being present in the alloy at from less
19 than 1.0 at% to 0.001 at%.

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21 6. The physical vapor deposition target of claim 5 wherein
22 silver is present in the alloy at from 0.005 at% to 0.1 at%.

1 7. The physical vapor deposition target of claim 5 comprising
2 an RF sputtering coil.

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4 8. An electroplating anode comprising an alloy of copper and
5 silver, with silver being present in the alloy at from less than 1.0 at%
6 to 0.001 at%.

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8 9. The electroplating anode of claim 8 wherein silver is present
9 in the alloy at from 0.005 at% to 0.1 at%.

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11 10. A metal alloy for use as a conductive interconnection in an
12 integrated circuit comprising copper and silver, with silver being present
13 in the alloy at from less than 1.0 at% to 0.001 at%.

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15 11. The metal alloy of claim 10 wherein silver is present in the
16 alloy at from 0.005 at% to 0.1 at%.

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18 12. A conductive integrated circuit metal alloy interconnection
19 comprising an alloy of copper and silver, with silver being present in
20 the alloy at from 50 at% to 70 at%.

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22 13. The interconnection of claim 12 wherein silver is present in
23 the alloy at from 55 at% to 65 at%.

1 14. The interconnection of claim 12 wherein silver is present in
2 the alloy at about 60 at%.

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4 15. The interconnection of claim 12 having higher
5 electromigration resistance than copper of a purity of greater than
6 99.999% of the same grain size.

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8 16. The interconnection of claim 12 having greater thermal
9 stability to grain size retention and crystal orientation retention than
10 copper of a purity of greater than 99.999% of the same grain size.

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12 17. A physical vapor deposition target comprising an alloy of
13 copper and silver, with silver being present in the alloy at from 50 at%
14 to 70 at%.

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16 18. The physical vapor deposition target of claim 17 wherein
17 silver is present in the alloy at from 55 at% to 65 at%.

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19 19. The physical vapor deposition target of claim 17 wherein
20 silver is present in the alloy at about 60 at%.

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22 20. The physical vapor deposition target of claim 17 comprising
23 an RF sputtering coil.

1 21. An electroplating anode comprising an alloy of copper and
2 silver, with silver being present in the alloy at from 50 at% to 70 at%.

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4 22. The electroplating anode of claim 21 wherein silver is
5 present in the alloy at from 55 at% to 65 at%.

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7 23. The electroplating anode of claim 21 wherein silver is
8 present in the alloy at about 60 at%.

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10 24. A metal alloy for use as a conductive interconnection in an
11 integrated circuit comprising copper and silver, with silver being present
12 in the alloy at from 50 at% to 70 at%.

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14 25. The metal alloy of claim 24 wherein silver is present in the
15 alloy at from 55 at% to 65 at%.

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17 26. A conductive integrated circuit metal alloy interconnection
18 comprising an alloy of copper and tin, with tin being present in the
19 alloy at from less than 1.0 at% to 0.001 at%.

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21 27. The interconnection of claim 26 wherein tin is present in
22 the alloy at from 0.01 at% to 0.1 at%.

1 28. The interconnection of claim 26 having higher
2 electromigration resistance than copper of a purity of greater than
3 99.999% of the same grain size.

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5 29. The interconnection of claim 26 having greater thermal
6 stability to grain size retention and crystal orientation retention than
7 copper of a purity of greater than 99.999% of the same grain size.

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9 30. The interconnection of claim 26 having an electrical
10 resistivity of less than 1.8 microohms.cm.

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12 31. A physical vapor deposition target comprising an alloy of
13 copper and tin, with tin being present in the alloy at from less than
14 1.0 at% to 0.001 at%.

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16 32. The physical vapor deposition target of claim 31 wherein tin
17 is present in the alloy at from 0.01 at% to 0.1 at%.

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19 33. The physical vapor deposition target of claim 31 comprising
20 an RF sputtering coil.

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22 34. An electroplating anode comprising an alloy of copper and
23 tin, with tin being present in the alloy at from less than 1.0 at% to
24 0.001 at%.

1 35. The electroplating anode of claim 34 wherein tin is present
2 in the alloy at from 0.01 at% to 0.1 at%.

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4 36. A metal alloy for use as a conductive interconnection in an
5 integrated circuit comprising copper and tin, with tin being present in
6 the alloy at from less than 1.0 at% to 0.001 at%.

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8 37. The metal alloy of claim 36 wherein tin is present in the
9 alloy at from 0.01 at% to 0.1 at%.

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11 38. A conductive integrated circuit metal alloy interconnection
12 comprising an alloy of copper and one or more other elements, the one
13 or more other elements being present in the alloy at a total
14 concentration from less than 1.0 at% to 0.001 at% and being selected
15 from the group consisting of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd,
16 Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd,
17 B, Ga, In, C, Se, and Te.

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19 39. The interconnection of claim 38 wherein the one or more
20 other elements are present in the alloy at a total concentration from
21 0.005 at% to 0.1 at%.

1 40. The interconnection of claim 38 having higher
2 electromigration resistance than copper of a purity of greater than
3 99.999% of the same grain size.

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5 41. The interconnection of claim 38 having greater thermal
6 stability to grain size retention and crystal orientation retention than
7 copper of a purity of greater than 99.999% of the same grain size.

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9 42. A physical vapor deposition target comprising an alloy of
10 copper and one or more other elements, the one or more other
11 elements being present in the alloy at a total concentration from less
12 than 1.0 at% to 0.001 at% and being selected from the group consisting
13 of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy,
14 Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd, B, Ga, In, C, Se, and Te.

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16 43. The physical vapor deposition target of claim 42 wherein the
17 one or more other elements are present in the alloy at a total
18 concentration at from 0.005 at% to 0.1 at%.

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20 44. The physical vapor deposition target of claim 42 comprising
21 an RF sputtering coil.

1 45. An electroplating anode comprising an alloy of copper and
2 one or more other elements, the one or more other elements being
3 present in the alloy at a total concentration from less than 1.0 at% to
4 0.001 at% and being selected from the group consisting of Be, Ca, Sr,
5 Ba, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb,
6 Lu, Ti, Zr, Hf, Zn, Cd, B, Ga, In, C, Se, and Te.

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8 46. The electroplating anode of claim 45 wherein the one or
9 more other elements are present in the alloy at a total concentration
10 at from 0.005 at% to 0.1 at%.

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12 47. A metal alloy for use as a conductive interconnection in an
13 integrated circuit comprising copper and one or more other elements,
14 the one or more other elements being present in the alloy at a total
15 concentration from less than 1.0 at% to 0.001 at% and being selected
16 from the group consisting of Be, Ca, Sr, Ba, Sc, Y, La, Ce, Pr, Nd,
17 Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Ti, Zr, Hf, Zn, Cd,
18 B, Ga, In, C, Se, and Te.

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20 48. The metal alloy of claim 47 wherein the one or more other
21 elements are present in the alloy at a total concentration from 0.005
22 at% to 0.1 at%.

1 49. A conductive integrated circuit metal alloy interconnection
2 comprising an alloy of copper and one or more other elements, the one
3 or more other elements being present in the alloy at a total
4 concentration from less than 1.0 at% to 0.001 at% and being selected
5 from the group consisting of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe,
6 Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and Pb.

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8 50. The interconnection of claim 49 wherein the one or more
9 other elements are present in the alloy at a total concentration from
10 0.005 at% to 0.1 at%.

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12 51. The interconnection of claim 49 having higher
13 electromigration resistance than copper of a purity of greater than
14 99.999% of the same grain size.

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16 52. The interconnection of claim 49 having greater thermal
17 stability to grain size retention and crystal orientation retention than
18 copper of a purity of greater than 99.999% of the same grain size.

1 53. A physical vapor deposition target comprising an alloy of
2 copper and one or more other elements, the one or more other
3 elements being present in the alloy at a total concentration from less
4 than 1.0 at% to 0.001 at% and being selected from the group consisting
5 of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ni, Pd,
6 Pt, Au, Tl, and Pb,

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8 54. The physical vapor deposition target of claim 53 wherein the
9 one or more other elements are present in the alloy at a total
10 concentration at from 0.005 at% to 0.1 at%.

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12 55. The physical vapor deposition target of claim 53 comprising
13 an RF sputtering coil.

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15 56. An electroplating anode comprising an alloy of copper and
16 one or more other elements, the one or more other elements being
17 present in the alloy at a total concentration from less than 1.0 at% to
18 0.001 at% and being selected from the group consisting of V, Nb, Ta,
19 Cr, Mo, W, Mn, Tc, Re, Fe, Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and
20 Pb.

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22 57. The electroplating anode of claim 56 wherein the one or
23 more other elements are present in the alloy at a total concentration
24 at from 0.005 at% to 0.1 at%.

1 58. A conductive integrated circuit metal alloy interconnection
2 comprising an alloy of copper and one or more other elements, the one
3 or more other elements being present in the alloy at a total
4 concentration from less than 1.0 at% to 0.001 at% and being selected
5 from the group consisting of V, Nb, Ta, Cr, Mo, W, Mn, Tc, Re, Fe,
6 Ru, Os, Co, Rh, Ni, Pd, Pt, Au, Tl, and Pb.

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8 59. The interconnection of claim 58 wherein the one or more
9 other elements are present in the alloy at a total concentration from
10 0.005 at% to 0.1 at%.

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